Protocol Binding Templates

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Outline and Examples

Use cases

- Mapping of the WoT abstract interactions (Events, Actions, Properties) to concrete protocols
- Devices and web services modeled using TD interactions
- Existing device ecosystems like OCF, LWM2M/IPSO, Bluetooth, Zigbee, Echonet
- HTTP, CoAP, MQTT, Websocket protocols
- IP and non-IP transports
- Multi-servient synchronization, protocol adaptation and model re-composition

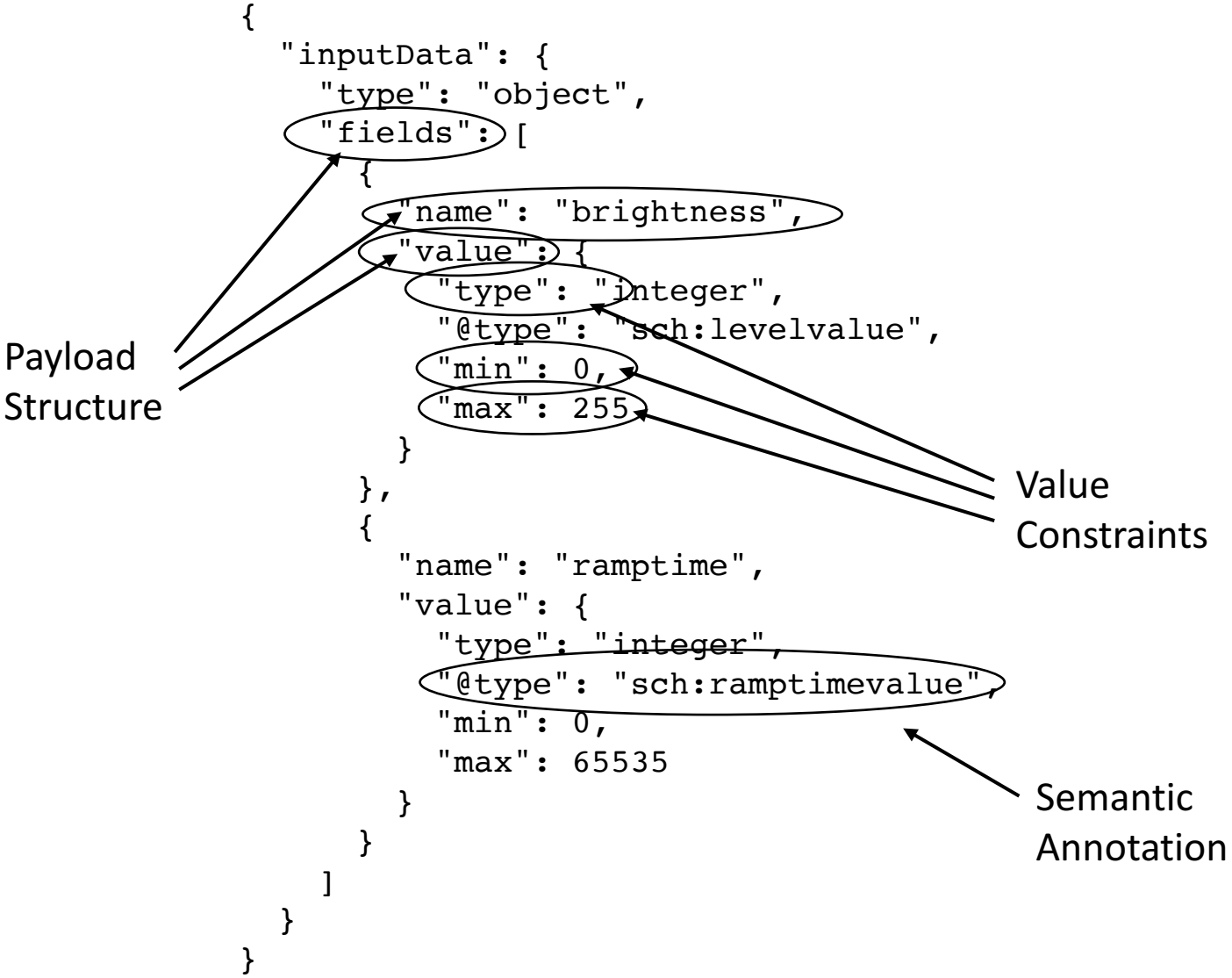
Protocol Adaptation

- The client uses information in the Thing Description to adapt to protocol specifics
  - Payload Structure
  - Value Constraints
  - Protocol Address
  - Protocol Methods
  - Protocol Options
  - Serialization Type (internet media type)

TD Interaction Design Pattern

- InputData and outputData elements describe the payload structural format
- Value Constraints enable the client to scale
- Protocol Address, method, options, and mediatype are described in the link element
- Semantic Annotation identifies the purpose of individual items in the data elements

Example inputData Element



Payload Structure

```
{
  "brightness": 127,
  "ramptime": 100
}
```

Payload Variation by Protocol

OCF Batch Interface

```
[
  {
    "href": "brightness",
    "rep": {
      "brightness:": 50
    }
  },
  {
    "href": "ramptime",
    "rep": {
      "ramptime:": 10000
    }
  }
]
```

LWM2M/IPSO

```
{
  "bn": "/3001/0/",
  "e": [
    {
      "n": "5001",
      "v": 0.5
    },
    {
      "n": "5003",
      "v": 10.0
    }
  ]
}
```

inputData for OCF Batch

```
{
  "inputData": {
    "type": "array",
    "items": [
      {
        "type": "object",
        "fields": [
          {
            "name": "href",
            "value": "brightness"
          },
          {
            "name": "rep",
            "type": "object",
            "fields": [
              {
                "name": "brightness",
                "value": {
                  "type": "integer",
                  "@type": "sch:levelvalue",
                  "min": 0,
                  "max": 100
                }
              }
            ]
```

inputData for LWM2M/IPSO

```
{
  "inputData": {
    "type": "object",
    "fields": [
      {
        "name": "bn",
        "value": "/3001/0/"
      },
      {
        "name": "e",
        "type": "array",
        "items": [
          {
            "type": "object",
            "fields": [
              {
                "name": "n",
                "value": "5001"
              },
              {
                "name": "v",
                "value": {
                  "type": "float",
                  "@type": "sch:levelvalue",
                  "min": 0.0,
                  "max": 1.0
                }
              }
```

Link Metadata Example

```
"link": [
  {
    "href": "/light",
    "mediatype": "application/vnd.ocf+cbor",
    "method": "post",
    "queryoptions": {
      "rt": ["oic.r.brightness", "oic.r.ramptime"],
      "if": ["oic.if.b"],
    },
    "headeroptions": {
      "12": 10000,
      "2053": 2048
    }
  }
]
```

Bindings for Properties

- Properties have get and set operations, the binding provides a way to specify the method in the target protocol that is to be used for the property.set operation

Bindings for Actions

- Actions have an invoke method on the target of the link, the method metadata defines which method in the target protocol is to be used for action.invoke
- action.invoke may create an action resource and return a TD describing the created resource
- The created resource has methods for updating and deleting the action resource as a way to modify the execution of the action in progress

Bindings for Events

- The Event binding describes how a client can monitor a source of events
- The client may use, for example, CoAP Observe, MQTT Subscribe, HTTP EventSource, or Websockets
- Events may use a create-subscription pattern to obtain a TD for a newly created resource which then may be monitored according to the returned TD

Vocabulary for Binding Templates

- Methods:
  - "method" keyword
  - "get", "put", "post", "delete", "patch", "subscribe", "observe", "publish" allowed values
- Options:
  - "headeroptions", "queryoptions" map keywords
  - key-value maps according to the concrete protocol
- Action keywords:
  - keywords for update and delete action operations?
- Event Keywords:
  - inputData parameters for conditional notification ?